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2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 1: Terminology, definitions, clinical examination, natural history, patellofemoral osteoarthritis and patient-reported outcome measures

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INTRODUCTION

Patellofemoral pain (PFP) typically presents as diffuse anterior knee pain, usually with activities such as squatting, running, stair ascent and descent. It is common in active individuals across the lifespan,[1–4] and is a frequent cause for presentation at physiotherapy, general practice, orthopaedic and sports medicine clinics in particular.[5 6] Its impact is profound, often reducing the ability of those with PFP to perform sporting, physical activity and work-related activities pain-free. Increasing evidence suggests that it is a recalcitrant condition, persisting for many years.[7–9] In an attempt to share recent innovations, build on the first three successful biennial retreats and define the 'state of the art' for this common, impactful condition; the 4th International Patellofemoral Pain Research Retreat was convened.

The 4th International Patellofemoral Research Retreat was held in Manchester, UK, over 3 days (September 2–4th, 2015). After undergoing peer-review for scientific merit and relevance to the retreat, 67 abstracts were accepted for the retreat (50 podium presentations, and 17 short presentations). The podium and short presentations were grouped into five categories; (1) PFP, (2) factors that influence PFP (3) the trunk and lower extremity (4) interventions and (5) systematic analyses. Three keynote speakers were chosen for their scientific contribution in the area of PFP. Professor Andrew Amis spoke on the biomechanics of the patellofemoral joint. Professor David Felson spoke on patellofemoral arthritis,[10] and Dr Michael Ratleff's keynote theme was PFP in the adolescent patient.[11] As part of the retreat, we held structured, whole-group discussions in order to develop consensus relating to the work presented at the meeting as well as evidence gathered from the literature.

Consensus development process

In our past three International Patellofemoral Research Retreats, we developed a consensus statement addressing different presentation categories.[12–14] In Manchester in 2015, we revised the format. For the exercise and physical interventions, we developed consensus based on reviews of systematic reviews, and these are reported in a companion publication.[15] For factors contributing to PFP, Professor Christopher Powers facilitated the discussion and development of consensus, which is published in another companion publication. For the remaining topics of terminology, definitions/diagnosis and features of clinical examination, a consensus discussion was led by KMC, with the results described below.

In addition to the consensus activities, two sections that had been features of prior consensus meetings underwent an update and synthesis of literature. The evidence related to natural history of PFP and patellofemoral osteoarthritis (OA) was described by JJS and KMC, while a recommendation on PROMs for use in PFP was completed by NJC, DBJ and JFE, based on the best available evidence.

The following pages present the 4th Patellofemoral Pain Consensus Statement regarding terminology, definitions, clinical examination, natural history, patellofemoral OA and patient reported outcomes (PROMs). These statements represent the contemporary status of knowledge in the field of PFP and hence, will change over time. This document was developed for clinicians and researchers, to improve our comprehension of this problematic condition, and provide a guide for better and more consistent assessment and management. Additionally, gaps in current knowledge can be identified and provide a basis for future research directions.

TERMINOLOGY

Two terms were proposed for the condition: (1) PFP and (2) patellofemoral arthropathy. PFP has been used as the preferred term over recent years, however, it does not take into account how non-painful joint conditions could be a precursor to pain development, does not include symptoms such as crepitus, and may increase a focus on the 'pain' aspect of the condition. The alternative term, patellofemoral arthropathy, was proposed, as part of the increasing recognition that PFP may be a symptom

of joint disease. Focusing on the disease process (arthropathy) might not be appropriate because: (A) the linkage between disease process and pain presentation is not clear, (B) pain is the predominant symptom, and (C) it could shift the focus to imaging, rather than clinical outcomes.

Statement 1. The term 'patellofemoral pain' is the preferred term, and is a synonym for other terms including: (1) PFP syndrome; (2) chondromalacia patella; (3) anterior knee pain and/or syndrome; and (4) runner's knee.

DEFINING PFP

Statement 2. The core criterion required to define PFP is pain around or behind the patella, which is aggravated by at least one activity that loads the patellofemoral joint during weight bearing on a flexed knee (eg, squatting, stair ambulation, jogging/running, hopping/jumping).

Additional criteria (not essential):

A. Crepitus or grinding sensation emanating from the patellofemoral joint during knee flexion movements
B. Tenderness on patellar facet palpation
C. Small effusion
D. Pain on sitting, rising on sitting, or straightening the knee following sitting

Statement 3. People with a history of dislocation, or who report perceptions of subluxation, should not be included in studies of PFP, unless the study is specifically evaluating these subgroups.

Currently, such patients are considered to be a subgroup of people with patellofemoral disorders and/or pain, who may have distinct presentations, biomechanical risk factors and require different treatments approaches.

CLINICAL EXAMINATION OF PFP

Clinical examination is the cornerstone to diagnose PFP,[16 17] but there is no definitive clinical test to diagnose PFP.[18]

Statement 4. The best available test is anterior knee pain elicited during a squatting manoeuvre: PFP is evident in 80% of people who are positive on this test.[18]

Additional tests (limited evidence):

Tenderness on palpation of the patellar edges (PFP is evident in 71–75% of people with this finding.[18]

Tests with limited diagnostic usefulness

- Patellar grinding and apprehension tests (eg, Clarke's test) have low sensitivity and limited diagnostic accuracy for PFP.[18 19]
- Knee range of motion and effusion.

NATURAL HISTORY

Incidence and prevalence of PFP

Statement 5. PFP is common in young adolescents, with a prevalence of 7–28%,[2 20 21] and incidence of 9.2%.[20]

Few studies have evaluated prevalence or incidence in other populations, except in the military,[4] where the annual incidence in men is 3.8% and in women is 6.5%, with a prevalence of 12% in men and 15% in women.[4]

Specialisation in a single sport was associated with a relative risk (1.5: 95% CI: 1.0 to 2.2) of PFP incidence compared to multisport athletes.[2]

PATELLOFEMORAL OSTEOARTHRITIS

Prevalence and impact of patellofemoral OA

Statement 6. Patellofemoral OA is an under recognised yet important subgroup of knee OA.[22 23]

Knee OA research has mainly focused on the tibiofemoral compartment, yet recent evidence suggests that the patellofemoral compartment is at least as commonly affected by OA.[24–26] Depending on the source population and definition of OA (ie, radiographic or MRI) isolated patellofemoral OA is present in 11–24% of older individuals and occurs in combination with tibiofemoral OA in 4–40% of people. People with patellofemoral OA exhibit similar patterns of pain and functional limitation to those with PFP.[27–31]

Risk factors/factors associated with patellofemoral OA

Statement 7. A variety of factors may alter the mechanics of the patellofemoral joint and increase joint stress, potentially leading to OA.

A. Abnormal patellofemoral joint alignment and trochlear morphology are associated with patellofemoral OA (both radiographic and MRI features). A recent systematic review[32] concluded that there is strong evidence that patellofemoral OA is associated with both abnormal trochlear morphology and frontal plane knee alignment. There is also limited evidence (due to the lack of longitudinal studies) that malalignment in the sagittal (patella alta) and axial (lateral patellar displacement and tilt) planes are associated with patellofemoral OA. However, there remains a knowledge gap regarding optimal measures and thresholds to best predict patellofemoral OA.
B. Muscle weakness: Quadriceps weakness is an important factor in patellofemoral OA. Quadriceps function, such as muscle size,[33] strength[34 35] and muscle force,[36] is impaired in people with patellofemoral OA. Importantly, quadriceps weakness is a risk factor for patellofemoral OA.[37] Weakness of muscle groups above the knee (involving the gluteii, often referred to as the 'proximal muscles') is well documented in young individuals with non-arthritic PFP.[16 38–42] Emerging evidence suggests that those with patellofemoral OA may also demonstrate proximal muscle dysfunction compared to controls, including lower gluteus minimus and medius peak muscle force,[43] and lower hip abductor strength.[44] These studies found no differences in gluteus maximus peak muscle force[43] or hip external rotator strength.[44] In the absence of longitudinal studies, the potential for hip muscle weakness to increase the risk of patellofemoral OA remains unknown.
C. Abnormal biomechanics: There is recent evidence that individuals with patellofemoral OA demonstrate abnormal biomechanics during gait.[36 43 45–47] Fok *et al*[36] reported that those with patellofemoral OA had lower knee extension moments, quadriceps forces and patellofemoral joint reaction forces during stair ascent and descent. In contrast to these findings, Pohl *et al*[44] reported that pelvis, hip and knee kinematics were not different between people with patellofemoral OA and controls. In the only longitudinal study to date, Teng *et al*[48] found that peak knee flexion moment and flexion moment impulse at baseline lead to progression of patellofemoral cartilage damage over 2 years.

Statement 8. Anterior cruciate ligament reconstruction (ACLR) increases the risk of patellofemoral OA.

There is radiographic and MRI evidence of patellofemoral OA following ACLR,[49–57] which appears to be independent of hamstring tendon or bone-patellar-bone autograft. While further longitudinal studies are required to elucidate the mechanisms underpinning patellofemoral OA following ACLR, it may be related to altered biomechanics and concomitant chondral damage.[56 58] Notably, patellofemoral OA following

ACLR is associated with worse symptoms and function[57] and deteriorating symptoms.[59]

Relationship between structure and pain

Statement 9. The relationship between abnormal joint structure and pain is imprecise. Patellofemoral pathology is traditionally considered to occur in the lateral compartment, which appears inconsistent with cartilage damage and bone marrow lesions (BMLs) on MRI (two hallmark features of OA on MRI) presenting in the medial and lateral patellofemoral joint.[60 61] An interesting finding was that PFP was only present with lateral patellofemoral joint damage and with concomitant medial and lateral structural damage, but not when there was only medial joint damage.[61] In a series of studies, Sharma *et al*[62] found that PFJ cartilage damage and BMLs were associated with prevalent frequent knee symptoms and incident persistent symptoms over 5 years and that worsening of preradiographic patelofemoral damage was associated with persistent knee symptoms.[63]

Statement 10. The infrapatellar fat pad is an intracapsular and extrasynovial tissue that is highly innervated and a potential cause of PFP.

The role of the fat pad in the patellofemoral OA disease process remains unclear. In a cohort of people with patellofemoral OA there was greater fat pad volume compared to controls, and greater fat pad volume was associated with greater knee pain severity.[64] In other cohorts of people with and without OA, greater fat pad size was associated with greater medial and lateral tibial and patellar cartilage volume,[65] and predicted lower knee pain at follow-up.[66]

Treatment of patellofemoral OA

Statement 11. Clinical features of patellofemoral OA may differ from tibiofemoral OA.

It is possible that in order to target effective rehabilitation treatments for those with patellofemoral OA, we need to recognise the clinical findings that identify and discriminate them from tibiofemoral OA. Schiphof *et al*[67] reported that the presence of crepitus in the knee and history of patellar pain were significantly associated with patellofemoral joint OA (but not tibiofemoral joint OA) in women. Other studies reported poor diagnostic ability of a variety of clinical examination findings self-reported knee pain location and with activities to discriminate those with patellofemoral OA from those with tibiofemoral OA.[34 68] This is an area requiring further investigation, as highlighted in the Felson editorial.[10]

Statement 12. A combined intervention[69] (ie, exercise therapy, education, manual therapy and taping) or patellofemoral bracing[70] may improve outcomes for people with patellofemoral OA.

Patellofemoral bracing may improve patellofemoral kinematics and knee pain and shrink BMLs in those with patellofemoral OA.[70 71 72] The only other study on patellofemoral bracing found a small but non-significant effect on knee pain.[73]

PATIENT-REPORTED OUTCOME MEASURES

PROMs are used by researchers and clinicians to follow the course of PFP and evaluate treatment outcomes. Typically administered as questionnaires, PROMs measure the patient's own perspective of their PFP and treatment, without interpretation of their response by another individual. This minimises observer bias, and captures aspects of PFP that are likely to be important to the patient.

Statement 13. Researchers should use a standard set of PROMs for PFP and OA to facilitate future comparisons and pooling of data.

These should encompass three core clinical constructs: pain, function and global assessment.[74] Researchers may also choose to evaluate quality of life and physical activity (optional constructs). Specific PROMs for each construct will be recommended in an upcoming paper, based on a Delphi exercise.

It should be noted that few PROMs have been developed specifically for PFP, raising the possibility that PROMs commonly used in research to date may lack content validity for this patient population.

FUTURE DIRECTIONS

The reporting in studies of patients with PFP can limit their knowledge translation and as a result, a Delphi exercise is underway, to determine the minimum design and reporting standards for PFP. The 5th International Patellofemoral Pain Research Retreat, will be held in Brisbane, Australia in July, 2017.

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